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The Split between Meaning and Being

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Abstract

The discussion in this article takes its point of departure in the generally accepted position of cognition oriented scientists that intelligent behaviour requires an organism/formalism which can abstract information from the environment. By examining some operationalized schema models the author shows to what extent these have been capable of explaining the development of behaviourally meaningful cognitive functions.

The discussion of the models is oriented towards techniques for specifying the position of the autonomous observer and on experiments that amplify the relationship between invariants and transformation. The presentation shows that efficient transaction with the environment rests on theoretical formulations that assume the cooperative interaction of a conscious organism with its environment. It is argued that primitive operations such as conditional judgment and classification are elementary and essentially unlearned activities. By condition oriented schema models leading to outcomes based on these operations, cognition oriented towards novel solutions cannot be obtained.

The leading idea of the present article is that meaning emerges in the organism's cooperation with its environment. Conceived in this way, meaning can be attributed neither to an organism nor to an environment. The phenomenon is novel and is characterized by properties which are fundamentally different from what is typical of its constituent components.

The Agent - action - Objective (AaO) paradigm, when put into a formalism (B. Bierschenk, 1984), controls the processes of differentiation and integration. Thus this paradigm constitutes the basis for a synthesizing of successive segments in the development of knowledge. Every novel phase in this development starts with a twist. The manipulable factors of the first phase, therefore, can only secondarily influence the cooperation between organism and environment. In the process, intention and orientation have been transformed into behaviour, which means that both, by the completion of the process, can no longer be treated differentially. That which operates in the new phase is embedded in the organism - environment cooperation. Through a complemantary arrangement of the components of this cooperation, novel characteristics will emerge. By that, variations in (1) the viewpoints of the environment and in (2) the perspective of the organism can be studied differentially, at the same time as meaning, i.e. what has significance for survival, becomes permanently integrated in the cognitive mechanism.

Progression in Behaviour

Progression implies a behaviour development in which every new phase is characterized by distinctive aspects, which increase the organism's autonomy in its cooperation with its environment and, consequently, also increase its chances to survive. The basic qualitative and quantitative change in the organism's progression that led to consciousness is, according to Grassé (1977, p 65) the development of the brain and the hand. Seen from a historical perspective, the eye has been the straight link to the brain, consciousness, and reason (Jaynes, 1976).

The eye, the hand, and their coordination have proved to be an attractive subject for cognitive science. Scientists oriented towards cognition research have long been trying to operationalize and to formalize cognitive functions starting with the eye - hand coordination. The point of departure for all these attempts is, in principle, this question:

> Can an organism's behaviour reflect the perceptual system's processing of the structural relations of an environment so that the behaviour could be taken as evidence of meaning?

The Operation Space of the Autonomous Observer

The most obtuse, at the same time, however, the most frequently employed method for detecting behavioural regularity, is the simple recording of sequences of more or less significant events. This approach is completely passive and builds on the prerequisite that an organism which is supplied with a nervous system is capable of registering that an event B has occurred after the event A, and that it has the tendency to expect B the next time A occurs.

The beginning of the development of an organism's observation ability has been connected with its ability to coordinate sight and body movement. This coordination presupposes an activity that twines together the perceiver with the perceived in a cooperative relation without which the meaning of the perceived cannot be established.

An operationalization of consciousness demands the invention of a behavioural metaphor. It creates the operation space within which alternative conducts to an environment can be discerned. The alternatives prerequire the ability of an organism to judge single action sequences. If, for example, an infant of only a few weeks of age is able to modify its behaviour on the basis of a perspective change, then the infant has to be conscious of its environment. Ball and Tronick (1971) may have reasoned something like this when they designed the psychophysical experiment in which the aim was to study the effects of varying (1) the viewpoints, (2) the perspective, and (3) both. Changes in the viewpoints were obtained by letting an infant respond to symmetrically expanding shadows, optically specifying the structure of an approaching object. This " phantom object " as well as a real object were approaching the infant's face symmetrically, which elicited the same kind of response in both cases.

Changes in the perspective were studied by the creation of transformative relations. When an object is transformed so that it is on a mispath in relation to an infant sitting in a chair in front of an experimental device, it becomes possible to show whether newborns are able to detect qualities of direction and relative depth of approach. A shadow or a real object elicited a different behaviour when on the mispath than when both moved symmetrically towards the infant's face.

In this approach, there was no room for the construction of a percept, i.e. the concept of a memory, because the structure to be perceived is contained in the medium. The meaning of the event emerges in the covariation of viewpoints and perspective, here an object approaching the " center of the self ", which implies danger for life. With this background, it may be of interest to reobserve the development of sensori-motor coordination in relation to judgment of danger when transformative relations emerge through the observer's active behaviour.

The Operationalization of The Action Component

A fundamental behaviour quality which is not dependent on a single sense organ is fear. The sensation that an organism experiences through the organismic activity ensued as a response to a threatening, noxious or destructive stimulus must be interpreted and judged with regard to its consequences. Behaviour geneticists have argued that a combined study of experience and genetic make up of the organism may give references to the ontogenesis of behaviour (Royce & Mos, 1979). The genetics of fear implies that its structural relations may give rise to more or less rigidly or plastically formed avoidance strategies. No doubt, the conceptualization of how an actively operating child may perceive fear has been a governing factor in the construction of the classical experiments with the Visual Cliff (Gibson & Walk, 1960).

The Visual Cliff. The instrument carrying the behaviourally significant information is a table-like device covered with a glass-top. It is divided into two equally large halves. Both have a textured surface consisting of checker-squared patterns. Under one half, the texture is placed directly underneath the glass surface, whereas under the other half, it is placed at flexible hight under the glass. In the earliest experiments, the infants were demanded to locomote (by crawling) and to orient themselves on the cliff. This experimental requirement could be satisfied by the placement of a lure such as a toy or the infant's mother opposite to the infant. If the infant refused to cross the deep side of the cliff, then this was taken as evidence of fear of hight and the conclusion about the presence of depth perception in the infant was drawn.

Depth perception is not reserved to humans alone. Comparative studies with different animal species show that animal infants can directly perceive ecologically meaningful information. Rosenblum and Cross (1963), for example, showed that three days old monkeys avoid the visual cliff. Many similar studies give evidence that infants operate behaviourally meaningful in this situation, which means that the cliff elicits the meaning of survival. Thus the preservation of the schema of direct perception is, as Piaget (1971, p 187) points out, not properly conceived as a problem of memory because the schema of an action is " the quality in the action ".

The Imperative of Association

With the emerging understanding of how to construct a machine which would be capable of algorithmically execute something that we might call meaning, it becomes necessary to inquire into how cognitive functions are conceived in a formal science - the field of Artificial Intelligence, to be precise. Shall the AI researchers be able to simulate the fashion in which the brain might build a cognitive code, they will have to formulate some hypothesis about how to represent an environment. Within AI, Becker (1973) has proposed a model which simulates pre-locomotor infants' sensori-motor experience on a cliff.

The cliff. The cliff is represented on a TV screen as a smooth shelf with a textured foreground, symbolizing a hard surface, and a colourless background, symbolizing the non-visible part of the environment. The visible part consists of a 3 x 3 units patterned matrix. Each unit is a square,which can either be black or white. The tactile part of the environment are the smooth shelf and the hard surface.

The eye. The eye represents the organism's perception, which is simulated through shifts of the viewpoints, as indicated by changes of colour. The eye functions non-panoramically, that is, it sees always only a two-dimensional surface of the objects (Becker, 1973, p 399).

The hand. The function of the hand is to represent motoric activity. It can, for example, either be open or closed. But it can also move horisontally or vertically. What position it takes in the eye's visual field is indicated by a red square. The hand has to detect solidity or a fall.

The action. The position and movements of the hand form the basis for Becker's simulation of Piaget's (1963) concept of groping. By a formalism functioning on the basis of recursive movements and cyclically recurrent activities, sensitivity to height is simulated.

The Projection Mechanism

The starting-point of the simulation of the development of a cognitive code is the premise that sensoric patterning cannot be understood without the postulation of (1) abstract features and (2) a projection mechanism. As non-sensory units for perceptual organization of observable configurations of properties and relations kernels are proposed, which contain, for example, the following kinds of basic words or composites of basic words:

Kernels	Comments
$\langle \text{ raise } \rangle_m$	Raise the hand one unit
$\langle \text{ grope DD } \rangle_m$	DD is a direction: left, right, or below
$\langle \text{ heightchange L } \rangle_d$	L is the new hand-level: top, middle, or bottom

m = motor
d = differential

Based on a number of such well-defined and verbalized features time and domain specific variations are conceptualized in terms of associative relations between different states. If projection is modelled with reference in associative and sequential operations, then it is logical to define a memory for sensory input and motor output. The task of the memory is to keep track of symbol pairs, where the symbol for sensory input is matched with the symbol for sensory output.

The starting up of the projection mechanism rests on an action function. In agreement with Young's (1978) argumentation, random possibilities are assumed for the occurrence of different events and for the formation of certain associative connections. What becomes reaffirmed by the environment becomes linked, whereas other randomly formed connections become decomposed. Therefore, there is no intrinsic necessity for a sensory system to respond to certain features or to continue the organization of certain particular patterns. The system must, however, be " endowed " with the ability to keep track of the fact that the event A has been followed by the event B, which is marked with the arrow (→). By that means, the task of the central nervous system is defined as to form S-R associations between afferent and efferent kernels in correspondence with the laws of statistical mechanics. Afferent kernels form the sensoric patterns in the following way:

$$\left[\langle \text{ Grope below } \rangle_m \rightarrow \ \dots \ \rightarrow \langle \text{ lower } \rangle_m \boldsymbol{\rightarrow} \langle \text{ Heightchange middle } \rangle_d \rightarrow \ \dots \ \rightarrow \langle \text{ colourchange center top red none } \rangle_d \right]$$

The efferent patterns are formally differentiated by an implication arrow (➧). The bracketed expression [ ] associates the conditions of the calculations to the results to be computed.

This " machine schema " operates on long, randomly generated sequences. The stability in the associative connections of the variables establishes, in the long run, the simulated organism's cognitive code. The variables that seem to be relatively invariant in relation to each other are generalized and classified. The schema exemplified above should be interpreted in the following way. The red square, which represents the hand in the center top position, moves to the middle, which implies a change of hight (d). This results in the center top becoming colourless (d). The variables of the bracketed expression provide for an optimization in the processing of long lists, specifying conditions, operations and results. Within the brackets, changes and reorganizations of the kernels are allowed. Through this measure, the physiological hypothesis is simulated that the brain does not function on the basis of immediate sensory input but on an abstract code developing by the influence of experience (Grossberg, 1980; Head, 1920; Melzack & Bromage, 1973; Young, 1978).

Internalization of Action

There is no reason to regard an organism's behaviour as resulting from simple associations between afferent and efferent kernels. Logical induction requires a modification of the basic control mechanism. A formally constructed procedure scope supplies the system with the capacity to focus its attention on a small range of behaviour according to the following proposition:

If y is of any value to x then x seeks or avoids y

Each of the internally represented variable combinations can with this modification discriminate between approach and avoidance. By that means, the construction of behaviour patterns is no longer made through simple associations but, instead, on the basis of a behaviour paradigm of relevance to the cliff. Thus in the simulation of an experience-based cognitive code, considerable regard to ecological functions has been taken. From this perspective, the simulated organism can differentiate between sensation and movement and can show sensitivity to height.

It is assumed that avoidance strategies develop from movements or actions, which may evoke repetitions, even if they have occurred quite accidentally (Piaget, 1963). By a propositional representation of such an occurrence, the organism's response to stimuli can be recursively determined and recursivity be defined as the result of a movement. The physiological assumption underlying the construction of this mechanism is that every single kernel can initially be associated to two or more internal representations. But after a conjunction with a particular group of kernels, it becomes restricted, that is, it can only belong to one " schema ". The function of the schema is to remember which one of the bonded S-R connections that a sensory input in the past had activated. The focus is on an organized complexity implying collectioning and conditioning of S-R bonds, techniques which give the impression of a strict environmentalism. To be sure, this simulated organism has the capacity to adapt its actions to its environment. But is does so without consciousness and without the autonomy of spontaneous self-preservation from an immediate sensory experience.

Binocular Disparity

An obvious problem in the interpretation of the infants' ability to extract ecological invariants on the visual cliff has been the role of the mother in the experimental setting. Clearly, her attractiveness is a confounding factor. In order to increase the ecological validity of the Visual Cliff experiments, pre-locomotor human infants were placed on the cliff. The eye - hand coordination, in this context, means that an infant is able (1) to see the patterning and (2) to feel the tactile properties of the glass surface. A significant expression of an infant placed on the cliff for the first time is its testing the solidity of the glass surface by tapping it. Moreover, Campos, Langer and Krowitz (1970) could show, by controlling heartbeats, visual attention, and vocalization of distress, that even two and three and a half months old infants are able to discriminate between the deep and the shallow side respectively, although without expressing fear. Another indicator of this discrimination is decelerated heartbeats in an infant when placed on the deep side. These results may be regarded as being of the same kind as the behavioural expression in the simulation of the eye - hand coordination. Attention and cardiac deceleration could simply be taken as evidence of perceived pattern complexity.

Pattern projection. When the squared patterns at both sides are of the same physical size the surface patterns are projected with different retinal angles. According to Bond (1972) the patterns then differ in density and complexity, which might have caused longer fixations. Therefore, repeated studies which corrected for the retinal projection were carried out with the result that the earlier findings could be verified. The conclusion drawn from this replication is that two months old infants are able to detect the properties specifying depth in that they can discriminate between the shallow and the deep side.

Further evidence of the significance of pre-locomotor infants' sensitivity to binocular disparity come from a dishabituation study. It was carried out by Appel and Campos (1977) and demonstrated that ecological invariants can be extracted from the environment, provided that the information flow displays some discontinuity. The fact that an organism can extract ecological invariants from a visual flow pattern was successfully demonstrated by Regan, Beverly, and Cynader (1979) with their psychophysical model for stereoscopic motion.

The theoretical implications of Becker's simulation of the concept of organism by the eye - hand coordination mechanism are quite clear by the circumstance that the organism is one-eyed and one-handed. This, namely, makes it inable to detect both (1) the transformative invariants which specify what is characteristic of a change in the environment and (2) the structural invariants which specify the identity of a structure under change. Instead of binocular disparity, a " disparity " between two different senses is modelled: what the eye can see on the textured surface and the hand can feel. In Gibson's (1979) terms, this is to say that " hight " is evident but has no affordance, i.e. meaning to the organism. The emergence of meaning is related to the judgment of consequences. After a fall, children of crawling age often show a clear wariness of edges (Campos, Hiatt, Ramsey, Henderson, & Svejda, 1978, p 158). These changes, whether they are related to the experience of edges or not, should be regarded as a function of a change in both the perspective and the viewpoints. Relating hight to danger for life is a process which is qualitatively different from a procedural establishment of a symmetry in variable lists.

The schematism of perception and action. As has been shown by Ball's and Tronick's experiment, there exists an innate ego-orientation. With growing locomotor experience and variation in perspective and viewpoints the organism develops a consciousness of itself, which gets its behavioural expression in self-awareness. Ecologically termed, a change takes place from locomotion to ego-motion. When ego-motion shifts into ego-orientation this is a process that twines together perspective structure and event structure. The manipulation of information as it is done with the visual cliff shows that direct perception does not depend on the organizational layout of the cliff, in that its ecological significant aspects can be detected.

What Becker has in common with an ecological and a psychogenetic approach to the study of cognitive development is the assumption that knowledge consists, basically, of information drawn from the environment. The decisive split arises by the " imperative of association " (I. Bierschenk, 1984), which objectifies not only the objective in relation to the observer, but the observer himself. Consequently, the invented organism and the simulated eye - hand coordination, by necessity, is dependent on a left-sided cognition. Thus the schema mechanism proposed by Becker is qualitatively different from the Kantian schema employed by Piaget and Gibson.

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